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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/822,512	04/02/2001	Koutaro Hachiya	Q63926	7509

7590 04/19/2005

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EXAMINER

FERRIS III, FRED O

ART UNIT	PAPER NUMBER
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2128

DATE MAILED: 04/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/822,512

Applicant(s)

HACHIYA, KOUTARO

Examiner

Fred Ferris

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f):
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

1. Claims 1-16 have been presented for examination based on applicant's request for reconsideration filed on 31 January 2005. Claims 1-16 remain rejected by the examiner.

Response to Arguments

2. Applicant's arguments filed 31 January 2005 have been fully considered.

Regarding applicant's response to 101 rejection: Applicants argue that the claimed subject matter provides a useful result that the examiner has not provided sufficient grounds for rejection. These arguments are respectfully traversed for the following reasons. The examiner has asserted that the claims have not recited a useful result in the technological arts as required by MPEP 2106. MPEP 2106 recites the following supporting rationale:

"A process that consists solely of the manipulation of an abstract idea is not concrete or tangible. See *In re Warmerdam*, 33 F.3d 1354, 1360, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994). See also *Schrader*, 22 F.3d at 295, 30 USPQ2d at 1459. Office personnel have the burden to establish a prima facie case that the claimed invention as a whole is directed to solely an abstract idea or to manipulation of abstract ideas or does not produce a useful result. Only when the claim is devoid of any limitation to a practical application in the technological arts should it be rejected under 35 U.S.C. 101. Compare *Musgrave*, 431 F.2d at 893, 167 USPQ at 289; *In re Foster*, 438 F.2d 1011, 1013, 169 USPQ 99, 101 (CCPA 1971)."

The examiner notes that, while applicants have argued that the claimed subject matter could be used for certain technical applications (i.e. electronic circuits), in this case, the language of the claims are devoid of any limitation to a practical application in the technological arts and is simply drawn to the manipulation of abstract ideas (i.e.

matrix reordering). That is, a **significant functionality** has not been recited in the language of the claims to satisfy a **useful result** as noted below in the 101 rejection. Further, the rejection has clearly established that the claims lack a concrete, tangible, and useful result and the examiner has expressly stated how the language of the claims has been interpreted to support the rejections. For example, on page 6 of the office action the examiner's rejections first states the following:

"The invention is not **useful** since the method and apparatus of claims 1-16 do not recite a result that is useful in the technological art. This makes it difficult to determine Applicant's invention since it merely claims a manipulation of abstract ideas by reordering elements of a coefficient matrix."

Page 6 of the rejection subsequently recites the following:

"While the preamble of independent claims 1, 2, 5, 6-8, 11 and 12 mention parallel processing and circuit simulation, the limitations of the claimed method steps merely appear to manipulate an abstract idea and do not recite a useful parallel processing or circuit simulation result. (The patent eligibility standard requires **significant functionality to be present to satisfy the useful result aspect** of the practical application requirement. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036.)"

Hence, the examiner has clearly established that the claim language does not recite a **useful result** and is simply drawn to the manipulation of abstract ideas (i.e. matrix reordering) and has therefore provided sufficient grounds for rejection as required by MPEP 2106. The examiner therefore maintains the 35 USC 101 rejection of claims 1-16.

Regarding applicant's response to 112(1) rejection: In evaluating the enablement issues relating to the "determinator" and "replacer" the examiner applied the factors as set forth in *In re Wands*. *In re Wands* (CA FC) 8 USPQ2d 1400, 1404 (9/30/1998) provides an 8 factor test for determining undue experimentation (MPEP 2164.01(a),

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factors (A) to (H)). Also see *White Consolidated Industries, Inc. v. Vega Servo-Control Inc.* (CAFC) 218 USPQ 961, 963 (7/25/83). Here the examiner determined several reasons for establishing a reasonable basis to question the enablement (MPEP 2164.04) of the “determinator” and “replacer” based on application of the undue experimentation factors (MPEP 2164.01(a), factors (A) to (H)). First, and as noted in the office action (page 7), the specification provided no description (algorithms, techniques, etc.) describing specifically how a skilled artisan would actually implement the claimed “determinator” and “replacer”. That is, the amount of direction provided to a skilled artisan (factor (F)) appears inconsistent with what which was required by the state of the prior art (factor (C)). Note that prior art Garg (background), for example, specifically address to problem of the complexity (difficulty) involved in attaining high performance in matrix computations. (i.e. factors (B), (C), and (E)) Second, the specification provided no clear definition of the terms “determinator” and “replacer” or how they were to be applied to the reordering of the matrix. Hence, the examiner determined that the quantity of experimentation (factor (H)) required by a skilled artisan to implement the claimed limitations (factor (A)) was relatively high when compared to the state of the prior art. A reasonable basis to question enablement therefore appears to be satisfied according to MPEP 2164.04. MPEP 2164(a) Undue Experimentation Factors further recites:

“A conclusion of lack of enablement means that, based on the evidence regarding each of the above factors, the specification, at the time the application was filed, would not have taught one skilled in the art how to make and/or use the full scope of the claimed invention without undue experimentation. In re Wright, 999 F.2d 1557, 1562, 27 USPQ2d 1510, 1513 (Fed. Cir. 1993).”

Therefore, when weighing the Wands factors, the examiner determined that based on the evidence regarding each of the undue experimentation factors, one skilled in the art would not know how to make and/or use the claimed subject matter from the description contained in the specification without undue experimentation.

ENABLEMENT BURDEN AND STANDARD. The "initial burden to establish a reasonable basis to question the enablement provided for the claimed invention" appears to be satisfied, according to MPEP 2164.04. Specifically, *In re Marzochi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971) states "it is incumbent upon the Patent Office, whenever a rejection on this basis [enablement] is made, explain why it doubts the truth or accuracy of any statement in a supporting disclosure and to back up assertions of its own with acceptable evidence or reasoning which is inconsistent with the contested statement". Here, the Examiner has presented some broad evidence (i.e. the terms "determinator" and "replacer" do not appear in the specification) and related specific technical reasons (see: office action page 7, paragraph 2) that clearly establish "a reasonable basis to question the enablement".

Thus, the burden should now be shifted to the Applicant to "present persuasive arguments, supported by suitable proofs where necessary", according to MPEP § 2164.05. However, applicants have merely referenced vague specification sections (page 7, lines 13-15, 18-20) and stated that a skilled artisan could somehow realize the "determinator" and "replacer" from passages that merely recite, "the system inputs the circuit description...", and "the above method ... is actualized by a computer program." These passages clearly do not provide sufficient guidance (direction) to a skilled artisan

such that the "determinator" and "replacer" could be implemented by computer program. The examiner therefore maintains the 112(1) rejection.

Regarding applicant's response to 103(a) rejection: The examiner concurs with applicants that Hachiya is the sole inventor of the 932' patent and therefore withdraws the rejection using Hachiya as prior art. However, since Hachiya was only relied upon for a teaching of parallel processing and pivoting within the matrix, the examiner has now rewritten the 103(a) rejection in view of another reference. Please see new 103(a) rejection below.

Regarding applicants proposed drawing changes: Applicant's proposed drawing changes filed 31 January 2005 have been approved by the examiner.

Priority

3. Applicant's claim for priority based on Japanese application number P2000-102163 filed on 4 April 2000 is acknowledged.

Information Disclosure Statement

4. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered. Specifically, page 2, line 6 of the

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specification references "Matrix Calculation Software", Dr. T. Kokuni, Maruzen Publishing Co. Japan, that has not been included in applicant's PTO-1492 IDS form.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1-16 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter. The Examiner submits that Applicant's have not recited any limitations relating to a practical application in the technological arts and have merely claimed a manipulation of abstract ideas (mathematical constructs). Section 2106 [R-2] (Patentable Subject Matter — Computer-Related Inventions) of the MPEP recites the following:

"In practical terms, claims define nonstatutory processes if they:
– consist solely of mathematical operations without some claimed practical application (i.e., executing a "mathematical algorithm"); or
– simply manipulate abstract ideas, e.g., a bid (Schrader, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (Warmerdam, 33 F.3d at 1360, 31 USPQ2d at 1759), without some claimed practical application."

In this case, claims 1-16 are simply drawn to the manipulation of abstract ideas (mathematical constructs - matrix reordering) as follows:

Claims 1-4, 7-10, and 13-16: method of matrix reordering, performing replacement of elements, and determining row and column combinations of a coefficient matrix.

Claims 5, 6, 11, and 12: apparatus for matrix reordering, selecting pivots, performing replacement of elements, and determining row and column combinations of a coefficient matrix.

An invention which is eligible for patenting under 35 U.S.C. § 101 is in the “useful arts” when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a **“useful, concrete and tangible result.”** The test for practical application as applied by the examiner involves the determination of the following factors:

(1) “Useful” - The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished.

(2) “Tangible” - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.

(3) “Concrete” - Another consideration is whether the invention produces a “concrete” result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

The Examiner respectfully submits, under current PTO practice, that the claimed invention does not recite either a useful, concrete, or tangible result and is merely drawn to a manipulation of abstract ideas.

- *The invention is not **useful** since the method and apparatus of claims 1-16 do not recite a result that is useful in the technological art. This makes it difficult to determine Applicant's invention since it merely claims a manipulation of abstract ideas by reordering elements of a coefficient matrix. While the preamble of independent claims 1, 2, 5, 6-8, 11 and 12 mention parallel processing and circuit simulation, the limitations of the claimed method steps merely appear to manipulate an abstract idea and do not recite a useful parallel processing or circuit simulation result. (The patent eligibility standard requires **significant functionality to be present to satisfy the useful result aspect** of the practical application requirement. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036.)*
- *The claims are not **tangible** since, for example, the results of the "replacement of elements" between rows and columns within the coefficient matrix are undefined. (see claims 1-5, for example)*
- *The claims are not **concrete** because the results are not assured. For example, is a solution possible for any and all arbitrary inputs? (i.e. any reordering or replacement of matrix elements)*

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

To expedite a complete examination of the instant application the claims rejected under 35 USC 101 (nonstatutory) above are further rejected as set forth below in anticipation of applicant amending these claims to place them in the four statutory categories of the invention. (See 35 USC 101 rejection)

6. Claims 5, 6, 11, and 12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. *The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.*

Specifically, apparatus claims 5, 6, 11, and 12 recite limitations relating to a "determinator" and a "replacer" whose structural elements (features) have not been disclosed in Figures 1-17, and, the examiner has found no teaching in applicant's specification that specifically discloses the operation of the "determinator" or the "replacer". In fact, the terms "determinator" and "replacer" do not appear to be present in the disclosure at all. Further, the specification provides no clear description (algorithms, techniques, etc.) sufficient to allow skilled artisan to actually implement the claimed subject matter. Accordingly, a skilled artisan would not be able to make and/or use the claimed invention's "determinator" and "replacer" from the description contained in applicant's specification. Applicant's preliminary amendment filed on 31 May 2001 and the proposed drawing changes filed 31 January 2001 merely labeling blocks S202 and S203 of Figure 1 with the terms "determinator" and "replacer" does not cure this deficiency.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. *Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,601,080 issued to Garg in view of "On Efficient Band Matrix Arithmetic", W. Eberly, IEEE 0-8186-2900-2/92, IEEE 1992.*

Independent claims 1,2, 5-8, and 11-13 are drawn to:

method and apparatus for reordering elements of a coefficient matrix representing linear simultaneous equations produced by parallel processing using Gaussian elimination by steps of:

- based on number of non-zero elements in coefficient matrix and accumulative processing time (lengths of critical paths) of Gaussian elimination of coefficient matrix, determining (determinator: claims 5,6,11,12) a first/second combination of row and column from the coefficient matrix

- performing replacement (replacer: claims 5,6,11,12) of elements between first/second combination of row and column within the coefficient matrix. (claim13: selecting/replacing pivots in the coefficient matrix)

Regarding dependent claims 1,2, 5-8, and 11-13: As outlined above, this group of independent claims includes the same limitations relating to a method, apparatus, and circuit simulation method for reordering the elements of a coefficient matrix representing linear simultaneous equations. These limitations are rendered obvious in view of the teachings of U.S. Patent 6,601,080 issued to Garg in view of U.S. Patent 6,144,932 issued to Hachiya. Garg discloses the elements of the claimed limitations of the present invention as follows:

- method and apparatus for reordering elements of a coefficient matrix representing linear simultaneous equations produced by parallel processing using Gaussian elimination: Garg discloses reordering to the elements of a coefficient matrix (Abstract, CL5-L29-37, Fig. 2) that represent linear simultaneous equations (Summary, CL1-L17, CL3-L1-5, CL9-L49) and the use of Gaussian elimination (CL5-L53).
- based on number of non-zero elements in coefficient matrix and accumulative processing time (lengths of critical paths) of Gaussian elimination of coefficient matrix, determining (determiner) a first/second combination of row and column from the coefficient matrix: Garg discloses determining the number of non-zero elements in the coefficient matrix (Abstract, CL3-L5, CL5-L39) for further determining combinations of rows and columns from the coefficient matrix (CL6-L20-40, Fig. 4). Garg also discloses the use of Gaussian elimination (CL5-L53) as noted above.

- performing replacement (replacer) of elements between first/second combination of row and column within the coefficient matrix. Garg discloses the replacement (substitution) and reordering of elements (CL1-L30, CL5-L29-35, Fig. 2) between multiple (1st, 2nd, etc.) combinations of rows and columns (CL6-L20-59, Fig. 4) within the coefficient matrix (Abstract, CL3-L2)

Garg does not explicitly disclose considering the accumulative processing time or length of critical paths.

Eberly discloses simulating the operation of an electronic circuit by parallel processing and using a coefficient matrix for solving simultaneous linear equations. In particular, Hachiya discloses these elements while also considering the accumulative parallel processing time and the length of critical paths. (Abstract, Sections) Eberly discloses the elements of the claimed limitations of the present invention as follows:

- accumulative processing time: Eberly considers the critical path execution time (processing time required) in parallel processing. (page 457, para: 3, 4, page 458, para : 4, Sections 2, 3)
- length of critical paths: Eberly considers the communication processing over a pivot line and numerical processing increase in execution time (hence, the path length) from the broadcast of the critical combined portion (page 458, para: 4, Sections 2, 3).

Per claim 13: Eberly further considers selecting/replacing between multiple (1st, 2nd, etc.) pivot line within the matrix (Sections 2, 3).

It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Garg relating to reordering the elements of a coefficient matrix representing linear simultaneous equations, with the teachings of Eberly relating to accumulative (total) parallel processing time and the length of critical paths, to realize the claimed invention. An obvious motivation exists since, in this case, the Garg reference teaches to the Eberly reference, and the Eberly reference teaches to the Garg reference. Specifically, both Garg and Eberly teach the reordering of coefficient matrices representing linear equations used in the same technical arena as noted above. Garg teaches to Eberly because Garg discloses that matrix methods have numerous applications including simulation of circuit design and semiconductor modeling (See: Garg CL1-L23). Eberly teaches to Garg because Eberly specifically discloses the use of these matrix methods for improving parallel processing. (See: Eberly) Further, the level of skill required by an artisan to realize the claimed limitations of the present invention is clearly established by both references. (See: Garg/Eberly, Abstract/Background) Accordingly, a skilled artisan having access to the teachings of Garg and Eberly, would have knowingly modified the teachings of Garg with the teachings of Eberly (or visa versa) to reduce the development time and cost in realizing the claimed elements of the present invention.

Regarding dependent claims 3, 4, 9, 10, and 14-15: These dependent claims are drawn to the additional steps of reordering (replacing) the matrix elements between combinations of rows and columns based on the symmetry of the coefficient matrix. Garg discloses matrix reordering of row and column selections based on the symmetric

properties (positive-definite) of the matrix. (CL1-L20, CL5-L15-27, Fig. 2) Accordingly, as skilled artisan would have knowingly incorporated reordering features based on the symmetric properties of the matrix using the same reasoning as noted above.

Per claim 16: Eberly further considers selecting/replacing between multiple (1st, 2nd, etc.) pivot line within the matrix (Sections 2, 3) and would have knowingly been incorporated by a skilled artisan as previously noted above.

Conclusion

8. *The prior art made of record and not relied upon is considered pertinent to applicant's disclosure, careful consideration should be given prior to applicant's response to this Office Action.*

U.S. Patent 5,655,137 issued to Kevorkian teaches solving simultaneous linear equations using coefficient matrices and parallel processors.

"A New Matrix Solution Technique for General Circuit Simualtin", R. Burch, IEEE Transactions on Computer Aided Design of IC's, vol. 12, No. 2, February 1993, teaches circuit simulation using simultaneous linear equations and coefficient matrices.

"Parallel Programming with Control Abstraction", L.A. Crowl, ACM transactions on Prog. Lang., Vol. 16, No. 3, May 1994, teaches solving simultaneous linear equations using coefficient matrices and parallel processors.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 703-305-9670 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry

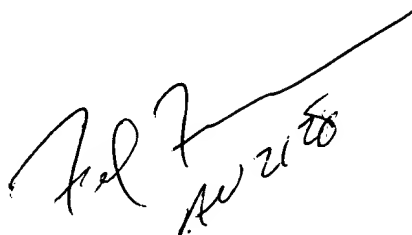
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of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 703-305-3900.

The Official Fax Numbers are:

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A handwritten signature in black ink, appearing to read "Fred Ferris", with a long horizontal line extending from the end of the signature.

April 13, 2005